DUBBO REGIONAL COUNCIL

TECHNICAL SCHEDULE

DRC-W103

CONSTRUCTION OF WATER TRUNK MAINS

TECHNICAL SCHEDULE DRC-W103 – CONSTRUCTION OF WATER TRUNK MAINS

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DRC-W103.1 SCOPE

This Specification applies to the construction of potable water trunk mains DN 300 mm and above after being designed in accordance with the Principal's design standards and specifications. This Specification is applicable to contracts:

a) That require construction only; with materials supplied by the Principal.
b) That require the supply of materials and construction of the works by the Contractor.
c) That are either Schedule of Rates or Lump Sum payment contracts.

The work required to be performed under this Contract shall comply with the referenced documents in Clause 0, unless specified otherwise herein.

DRC-W103.2 REFERENCED DOCUMENTS

The following documents are referred to in this Specification. The latest version of the document including any published amendments shall apply. Where the drawings or a project specific specification are in conflict or inconsistent with these referenced documents or this Specification, then the details on the drawings or project specific specification shall apply.

Australian Standards

AS 1111 ISO metric hexagon commercial bolts and screws.
AS 1112 ISO metric hexagon nuts.
AS 1214 Hot dipped galvanised coating on threaded fasteners.
AS 1237 Plain washers for metric bolts, screws and nuts for general purposes.
AS 1281 Cement mortar lining of steel pipe and fittings.
AS 1289 Methods of testing soils for engineering purposes.
AS 1379 Specification and supply of concrete.
AS 1477 PVC pipes and fittings for pressure applications.
AS 1579 Arc-welded steel pipes and fittings for water and wastewater.
AS 1627 Metal finishing.
AS 1646 Rubber joint rings for water supply, sewerage and drainage purposes.
AS 2032 Code of Practice for installation of UPVC pipe systems.
AS 2280 Ductile iron pressure pipe and fittings.
AS 2566 Buried flexible pipelines.
AS 2638 Cast iron sluice valves for waterworks purposes.
AS 3952 Spring hydrants for waterworks purposes.
AS 3680 Polythene sleeving for ductile iron pipes.
AS 3681 Application of polyethylene for ductile iron piping.
AS 4020 Testing of products for use in contact with drinking water.
AS 4087 Metallic flanges for waterworks purposes.
AS 4130 Polyethylene (PE) pipes for pressure applications.
AS 4158 Thermal-bonded polymeric coatings on valves and fittings for water industry purposes.

AS 4321	Fusion bonded medium-density polyethylene coating and lining for pipes and fittings.
AS 4441	Oriented PVC (PVC-O) pipes for pressure applications.
AS 4680	Hot dip galvanised (zinc) coatings on fabricated ferrous articles.
AS 4765	Modified PVC (PVC-M) pipes for pressure applications.
AS 4791	Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process.
AS 4792	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialised process.
AS 4794	Non-return valves – swing check and tilting disc.
AS 4795	Butterfly valves for waterworks purposes.
AS 4956	Air valves for water supply.

Works shall also comply with the current versions all other relevant Australian Standards where not specifically listed above.

Water Services Association of Australia Standards

WSA01	Polyethylene Pipeline Code
WSA03	Water Supply Code of Australia
	WSAA Product Specifications

DRC-W103.3 STANDARDS

Construction of the Work Under Contract (WUC) shall be undertaken in accordance with WSA03-2011 Water Supply Code of Australia, Part 2: Construction.

DRC-W103.4 DELIVERY, TRANSPORTATION, HANDLING AND STORAGE OF MATERIALS

Materials used shall be as specified by the drawings or Project Specification.

Delivery, transportation, handling and storage of all products and materials shall be undertaken in accordance with the manufacturer's recommendations and clause 12.2 and 12.3 of WSA03-2011.

All pipe, fittings and associated mechanical equipment shall be suitable for the conveyance of potable water and shall meet the requirements of AS 4020.

DRC-W103.5 POLYVINYLCHLORIDE (PVC) PIPE

PVC pipe shall be either:

- Modified PVC (PVC-M) compliant with WSAA Product Specification WSA PS-209 and manufactured in accordance with AS 4765.
- Oriented PVC (PVC-O) compliant with WSAA Product Specification WSA PS-210 and manufactured in accordance with AS 4441.

- Unplasticised PVC (PVC-U) compliant with WSAA Product Specification WSA PS-211 and manufactured in accordance with AS 1477.

All PVC pipe shall be:

- Minimum pressure class PN18.
- Series 2 compliant with external diameter compatible with ductile iron pipe.
- Coloured blue for potable water.
- Rubber ring jointed.
- Used with ductile iron fittings.
- Installed in accordance with AS 2032 and with detectable marker tape to assist with future pipe location.
- Minimum DN 100 mm.

DRC-W103.6 DUCTILE IRON PIPE AND FITTINGS

Ductile iron pipes shall be compliant with Water Services Association of Australia (WSAA) Product Specification WSA PS-200 and cement lined in accordance with AS 1281 (DICL).

Ductile iron fittings shall be compliant with WSAA Product Specification WSA PS-201 or WSA PS-212 and shall be provided with external and internal coating in accordance with AS 4158.

Ductile iron pipes and fittings shall be:

- Manufactured in accordance with AS 2280.
- Minimum pressure class PN35 (alternatively flange class may be used).
- Rubber ring or flanged jointed.
- Externally coated with a bituminous or synthetic resin coating to AS 2280.
- Externally wrapped in a loose-sleeved polyethylene complying with WSAA Product Specification PS-320, AS 3680 and AS 3681. Sleeve shall be coloured blue for potable water.

DRC-W103.7 MILD STEEL CEMENT LINED (MSCL) PIPE AND FITTINGS

MSCL pipes and fittings shall be compliant with WSAA Product Specifications WSA PS-203 and WSA-204 and shall be:

- Manufactured in accordance with AS 1579.
- Cement mortar lined in accordance with AS 1281.
- Externally coated with a fusion bonded medium density polyethylene coating system in accordance with AS 4321.
- Minimum wall thickness of 5 mm for pipes 300 mm diameter and smaller.
- Minimum wall thickness of 6 mm for pipes larger than 300 mm and all mitre bends and pipe specials.

DRC-W103.8 POLYETHYLENE (PE) PIPE AND FITTINGS

PE pipes and fittings shall be compliant with WSAA Product Specifications WSA PS-207, WSA PS-208 and WSA PS-215 and shall be:

- PE100.
- Manufactured in accordance with AS 4130.
- Minimum pressure class PN16.
- Coloured black with blue stripes for potable water
- Electrofusion or butt welded jointed.
- Installed with detectable marker tape to assist with future pipe location.

DRC-W103.9 STOP VALVES – SLUICE VALVES

Unless noted otherwise, stop valves shall be resilient seated sluice valves compliant with WSAA Product Specification WSA PS-261 and shall be:

- Manufactured in accordance with AS 2638.
- Minimum pressure class PN16.
- Suitable for buried service.
- Provided with external and internal fusion bonded epoxy coating in accordance with AS 4158.
- Anti-clockwise closing.
- Provided with an extension spindle compliant with WSAA Product Specification WSA PS-269 where required so that the valve can be operated by a key at a depth not exceeding 300 mm from the ground surface.

DRC-W103.10 STOP VALVES – BUTTERFLY VALVES

Where specified, butterfly valves shall be compliant with WSAA Product Specification WSA PS-263 and shall be:

- Manufactured in accordance with AS 4795.
- Minimum pressure class PN16.
- Double flanged unless noted otherwise.
- Suitable for buried service.
- Provided with external and internal fusion bonded epoxy coating in accordance with AS 4158.
- Anti-clockwise closing.
- Installed with trunnions horizontal and have a manual gearbox actuator (fully enclosed) suitable for buried service that can be operated from the surface.
- Provided with suitable stops to prevent over travel of the disc beyond fully opened and fully closed position.
- Provided with an extension spindle compliant with WSAA Product Specification WSA PS-269 where required so that the valve can be operated by a key at a depth not exceeding 300 mm from the ground surface.

DRC-W103.11 HYDRANTS

Hydrants shall be spring hydrants compliant with WSAA Product Specification WSA PS-267 and shall be:

- Manufactured in accordance with AS 3952.
- Minimum pressure class PN16.
- Provided with external and internal coating in accordance with AS 4158.
- Installed with a hydrant riser as required so that the face of the hydrant is between 75 mm and 225 mm below the top of the underside of the hydrant surface cover.

DRC-W103.12 AIR VALVES

Air valves shall be compliance with WSAA Product Specification WSA PS-265 and shall be:

- Dual acting air valves.
- Manufactured in accordance with AS 4956.
- Suitable for use with potable water.
- Installed with an isolation valve.
- Minimum diameter DN80 mm.

DRC-W103.13 NON-RETURN VALVES

Non-return valves shall be compliant with WSAA Product Specification WSA PS-264 and shall be:

- Manufactured in accordance with AS 4794.
- Minimum pressure class PN16.
- Full bodied swing check type.
- Provided with external and internal coating in accordance with AS 4158.

DRC-W103.14 PRESSURE REDUCING VALVES

Pressure reducing valves shall be of a type, make and model as approved by the Principal and shall be installed in accordance with the manufacturer's instructions. Pressure reducing and associated valves shall be installed in a below-ground pit.

DRC-W103.15 MECHANICAL JOINTS

Mechanical joints such as gibault joints and dismantling joints shall have a minimum pressure class of PN16 and shall comply with the WSAA Product Specification WSA PS-270 or WSA PS-271 as applicable.

DRC-W103.16 FLANGES

All flanges shall be a minimum pressure class of PN16 and comply with AS 4087, unless noted otherwise on the drawings or as necessary to match existing flanges.

DRC-W103.17 FASTENERS

All bolts, nuts and washers shall be galvanised in accordance with AS 1214 or stainless steel grade 316. Hexagon bolts shall comply with AS 1111, hexagon nuts shall comply with AS 1112 and washers shall comply with AS 1237.

DRC-W103.18 GASKETS

Elastomeric gaskets for rubber ring jointed pipes and flanges shall be compliant with WSAA Product Specification WSA PS-312 and AS 1646. Gaskets shall be supplied in bags and not supplied directly fitted to the ends of pipes. Gaskets shall be stored in accordance with the manufacturer's recommendations in bags with protection from UV radiation and shall be suitable for outdoor storage for up to two years.

DRC-W103.19 TAPPING BANDS

Mechanical tapping bands, for connecting property services to reticulation mains, shall be compliant with WSAA Product Specification WSA PS-310.

DRC-W103.20 METALWORK

Structural steelwork, ladders, brackets, covers and other metalwork shall be blast cleaned for AS 1627 Class 3 and hot dip galvanised to AS 4680, AS 4791 or AS 4792 as applicable.

DRC-W103.21 CONCRETE

Concrete shall be compliant with WSAA Product Specification WSA PS-357 for normal class and shall comply with AS 1379.

DRC-W103.22 TRENCH FILL MATERIAL

Trench fill in trafficable areas shall be 20 mm crushed rock in accordance with Transport for NSW (TfNSW) standard specifications for DGS20.

Trench fill in non-trafficable areas may be select excavated or imported material and shall be free of vegetation, organic matter, debris, and rocks with a dimension not greater than 75 mm in any direction. Select material shall be capable of compaction, without excessive effort, to a mean value of density ratio (R_D) of not less than 95%.

DRC-W103.23 EMBEDMENT MATERIAL

Fine crushed rock embedment shall be compliant with WSAA Product Specification WSA PS-359.

Compaction sand embedment shall be Grade A and be compliant with WSAA Product Specification WSA PS-350.

DRC-W103.24 LOCATION

The location, sizes, pressure class and other details of the pipelines are shown on the drawings. The location of appurtenances such as valves and hydrants are also shown on the drawings. The pipelines and appurtenances shall be constructed to the locations shown on the drawings unless directed otherwise by the Superintendent.

DRC-W103.25 COVER OVER PIPES

The minimum depth of cover over pipes, measured vertically from the finished surface level to the top of any pipe, flange or socket shall be as follows:

- 450 mm in non-trafficable locations in residential areas (eg nature strips).
- 600 mm in non-trafficable locations in industrial areas (eg nature strips).
- 600 mm under sealed roadways and footpaths.
- 750 mm under major roadways or embankments.

The maximum cover for water reticulation mains shall be 1500 mm unless otherwise approved by the Superintendent.

DRC-W103.26 CROSSINGS

Where a pipeline crosses a main road, creek or involves features under the control of any Authority, the affected work shall be carried out in accordance with the requirements of that Authority. It shall be the Contractor's responsibility to complete written notification to the Authority of the intention to carry out the work.

DRC-W103.27 EXCAVATION

All excavations for structures and pipes shall be to the lines, grades and forms shown on the drawings or directed by the Superintendent within the specified tolerances. Excavation shall be undertaken in accordance with Clause 13 of WSA03-2011. Minimum trench width for pipes shall be in accordance with the drawings and AS 2566. Where a trench is excavated across a paved surface, the trench width shall be kept to a minimum and bitumen and concrete surfaces saw cut in a neat straight line.

Spoil shall not be placed within 1000 mm from the zone of influence at the edge of any excavation. Excavated materials shall not be placed against the walls of any building or fence without the written permission of the owner of such building or fence. Topsoil from excavations shall be kept separate and utilised to make good the surface after backfilling.

The Contractor shall adequately support all excavations as the works proceed. When withdrawing supports, the Contractor shall exercise every precaution against slips or falls by means of intermediate shoring, planking or props. Backfilling shall be performed simultaneously with the withdrawal of supports.

At the completion of each work day, excavations should be preferably filled. Any excavations left open shall be suitably secured and left safe for the pubic and others in the vicinity of the site. As a minimum open excavations shall be secured with security fencing or steel road plates.

The Contractor shall undertake erosion and sediment control at the site in accordance with WS-101 General Construction.

DRC103.28 ROCK EXCAVATION

Unless noted otherwise, the Contract Sum is deemed to include excavation in any material including excavation in rock. Any delay due to the presence of rock shall be at the Contractor's expense and the Contractor shall not be entitled to any extension of time due to such delay.

Definition of Rock

Where rock excavation is stated to not be included in the Contract Sum, rock shall be defined as solid bedrock material than can only be efficiently excavated using a rock hammer attached to an excavator as determined by the Superintendent. Boulders and rippable material are not deemed to be considered rock and deemed to be included in the Contract Sum.

Measurement for payment of rock excavation, where provided for in the Contract, shall be measured based on the minimum trench width required. If the Contractor believes it has encountered rock, the Contractor shall notify the Superintendent within four hours. The Superintendent shall then inspect the material and determine whether the material is considered to be rock.

DRC-W103.29 BEDDING FOR PIPES

The trench floor shall be prepared and pipe bedding and support placed in accordance with Clause 14 of WSA03-2011.

DRC-W103.30 LAYING OF PIPES

Laying of pipes shall be undertaken in accordance with Clause 15 of WSA03-2011.

Before being laid, all pipes, fittings, valves and other appurtenances shall be cleaned and examined by the Contractor. The Contractor shall ensure that the interior of the pipeline is clean and free from obstructions. Approved exclusion caps or plugs shall be used to prevent foreign matter entering sections of pipeline which are left uncompleted overnight.

Detectable marker tape shall be laid on top of the pipe embedment for all non-metallic pipes, except for trenchless installations where tracer wire shall be used instead.

Pipes shall be cut as needed, or directed by the Superintendent, to suit closing lengths, to remove damaged pipe or fittings, or to remove sockets if necessary when jointing a socketed fitting. For field cuts of DICL pipes, the Contractor shall only use an approved mechanical pipe cutter. The Contractor shall ensure that firefighting equipment, in working order, is on the site prior to the field cuts being made. If the Contractor proposes to use a petrol engine pipe cutter in an excavation, the Contractor shall ensure that a safe atmosphere is maintained for workers in the excavation at all times. Any pipes cut in the field shall have their ends prepared in accordance with the manufacturer's written instructions, or as directed by the Superintendent.

Cutting of asbestos cement (AC) pipes is not permitted. The AC pipe must be excavated to the nearest pipe collars and the collars cracked. Once the collars are removed, a new section of DICL pipe shall be installed by use of gibault joints. The AC pipe materials shall be disposed of safely and in accordance with relevant legislation.

DRC-W103.31 TRENCH STOPS

Trench stops shall be constructed on all pipes with a grade steeper than 5% (ie 1 in 20). Spacings of trench stops shall be calculated using the following formula:

Trenchstop spacing (m) = 100 / Grade (%)

DRC-W103.32 BULKHEADS

Concrete bulkheads shall be constructed on all pipes with a grade steeper than 15%.

For pipe grades between 15% and 29%, spacings of bulkheads shall be calculated using the following formula:

Bulkhead spacing (m) = L / Grade (%) where L = 80 x pipe length (m) (450 m max)
Where L > 100 m also construct intermediate trench stops at spacing < 100/grade (%)

For pipe grades between 30% and 50%, spacings of bulkheads shall be calculated using the following formula:

Bulkhead spacing (m) = 100 / Grade (%)

DRC-W103.33 WRAPPING

All buried fasteners (bolts, nuts, washers), mechanical joints, tapping bands and flanges shall be protected for corrosion using an approved protective system. Protection shall include a primer, mastic and tape with an overwrap applied in accordance with the manufacturer's instructions.

DRC-W103.34 VALVE CHAMBERS

Where specified on the drawings, the Contractor shall construct valve chambers of the type shown on the drawings.

Covers shall be finished flush with the surface in roadways, footpaths and paved surfaces. Elsewhere, covers shall be finished 25 mm above the surface of the ground, or such other level as directed by the Superintendent, in a manner designed to avoid as far as possible, soil being deposited over the cover.

DRC-W103.35 THRUST AND ANCHOR BLOCKS AND RESTRAINED JOINTS

Thrust and anchor blocks shall be constructed at valves, flexible jointed bends/tees/tapers and ends of PE pipelines as shown on the drawings and detailed in WSA03-2011 clause 15.7.

Restrained pipe systems may be used in place of thrust and anchor blocks where shown on the drawings, or as otherwise approved by the Superintendent.

The Contractor shall provide temporary anchorages adequate to restrain the pipe when under test. The cost of providing such anchorages shall be deemed to be included in the rates tendered for laying and jointing pipelines.

DRC-W103.36 CONCRETE ENCASEMENT

Concrete encasement shall be undertaken in accordance with WSA03-2011 clause 16.6.

Where pipes have less than 450 mm of cover above the top of the pipe barrel and where approved by the Superintendent, they shall be encased in concrete. Concrete shall be minimum grade N20 and shall be for the full width of the excavated trench and be a minimum of 150 mm above and below the pipe barrel. For trenches in rock, the depth of the concrete encasement may be reduced to 100 mm below the pipe barrel.

In trenches of other than rock or fissured rock, a contraction joint consisting of a layer of bituminous felt 12 mm thick shall be formed in the concrete encasement at the face of each socket or at one face of each coupling.

Reinforcement in concrete encasement shall be as shown on the drawings.

DRC-W103.37 TRENCH FILL

Trench fill shall be undertaken in accordance with WSA03-2011 Clause 17.

Trench fill in trafficable areas shall be 20 mm of crushed rock as per Clause 0. Trench fill material shall be placed and compacted in layers not exceeding 200 mm loose thickness, and shall be moisture conditioned as required to facilitate compaction to the required density. The minimum dry density ratio (AS 1289.5.4.1) as measured using the Modified Compaction test (AS 1289.5.2.1) for trafficable areas shall be 95% except for the top 100 mm under existing roads which shall be 98%. In the event that the road owner has trench fill requirements which exceed the above, the road owner's requirement shall take precedence and apply.

Trench fill in non-trafficable areas may be select excavated or imported material complying with Clause 0. The Contractor shall establish the optimum loose layer thickness to achieve the required compaction, however this shall not exceed 300 mm. The minimum dry density ratio of non-trafficable trench fill shall be 90% except for the top 600 mm of the trench which shall be 95%. Where the works are located in areas with cohesionless soils (eg sand or silty sands) and using cohesionless trench fill then trench fill in non-trafficable areas shall achieve a Density Index (AS 1289.5.6.1) relative density of 60% or PSP /DCP penetration resistance of seven blows per 300 mm.

DRC-W103.38 BORED PIPES UNDER ROADS, DRIVEWAYS AND ELSEWHERE

Trenchless construction of pipes shall be undertaken in accordance with WSA03-2011 Clause 15.15.

The installation of rubber ring jointed pipes (which are not specifically designed for trenchless technology applications) within unsleeved boreholes may only be undertaken if shown on the design drawings and the following requirements are met:

- No more than two joints are contained in the borehole.
- The pipe has sufficiently strong sockets and sufficient stiffness (PVC-O is not acceptable).
- The borehole has structural integrity and retains a clean and clear borehole surface free from significant debris.
- The use of spacers is required for DICL to prevent the outer coating from being damaged.
- Mechanical equipment may not be used to push the pipe through the borehole.
- Exclusion caps are used to keep the inside of the pipe clean as it is pushed through the borehole.

Where the annular void for the borehole exceeds 50 mm, then this shall be grouted with an approved grout mix.

DRC-W103.39 PROTECTION

Where MSCL pipework is used, cathodic protection shall be installed as specified on the detail design. All cathodic protection works shall be installed by an experienced corrosion protection contractor.

All connections between dissimilar metals shall be insulated to ensure that dissimilar metals are electrically separated.

DRC-W103.40 MARKERS

Opposite each stop valve, scour valve, air valve and hydrant the Contractor shall fix a marking plate in a manner and position as shown on the drawings, or otherwise approved by the Superintendent.

Where the hydrant is more than a 3 m distance from any existing wall, fence, kerb face or post the Contractor shall fix the relevant marking plate with four galvanised screws or clout nails at the top of a post, facing the valve or hydrant.

The post shall be white in colour and be either 100 mm^2 reinforced concrete with 20 mm chamfers, a powder coated metal post, recycled plastic post with recesses for marker plates of any other post approved by the Principal. When installed the top of the post shall be 1200 mm above the ground and installed to a depth of at least 500 mm into the ground.

Marking plates shall be fixed as soon as practicable after each valve or hydrant is installed. However, marking plates for hydrants shall be temporarily covered using masking tape, or other approved cover which shall be removed by the Contractor on satisfactory completion of the pressure testing of the pipeline.

In addition to the marking plates, two-way reflective raised pavement markers, blue in colour, are to be affixed to the road pavement with an approved epoxy adhesive directly opposite the location of all hydrants on the centerline of the roadway.

DRC-W103.41 SWABBING

Swabbing of constructed pipelines in accordance with WSA03-2011 clause 18 unless otherwise approved by the Superintendent.

DRC-W103.42 COMPACTION TESTING

Compaction testing shall be carried out in accordance with WSA03-2011 Clause 19.3 unless required otherwise by the road owner or modified otherwise by the Superintendent.

DRC-W103.43 HYDROSTATIC PRESSURE TESTING

All pipelines greater than 20 m in length shall be hydrostatically pressure tested after concrete thrust restraint curing times have elapsed. Hydrostatic pressure testing shall be undertaken in accordance with WSA03-2011 Clause 19.4.

The Contractor shall provide the Superintendent with a minimum of three clear working days' written notice prior to carrying out hydrostatic pressure testing. This notice must be in writing and specify the pipeline sections to be tested, as well as the time, date and location of the test and equipment to be used (refer Appendix A for an example notification form).

Pressure testing shall not be carried out during wet weather unless otherwise approved by the Superintendent.

Before testing a pipeline section, it shall be cleaned to the satisfaction of the Superintendent and filled slowly with water, taking care that all air is expelled. Purging of air from rising mains shall be promoted by opening air valves. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing.

Hydrostatic pressure testing shall be conducted in accordance with the following methods:

Pipeline Type	Test Method	Test Duration
PVC, DICL, MSCL	AS 2566.2 M4 Constant Pressure (Water Loss)	5 hours
PE	WSA01-2004 Clause 2.13.	5 hours
Mixed with >5% PE by length	WSA01-2004 Clause 2.13.	5 hours
Mixed with <5% PE by length	AS 2566.2 M4 Constant Pressure (Water Loss)	5 hours

The test pressure shall be as shown on the drawings and shall be no lower than 1200 kPa and no higher than the pressure rating of the pipeline system components including pipes, valves, fittings and thrust blocks.

The pressure testing of a section shall be considered to be satisfactory if all the following are achieved:

(a) There is no failure of any thrust block, pipe, fitting, valve, joint or any other pipeline component;
(b) There is no visible leakage; and
(c) The quantity of make-up water, necessary to maintain the test pressure, does not exceed the allowable quantity of make-up water.

Any failure, defect, visible leakage and/or excessive leakage rate, which is detected during the pressure testing of the pipeline or during the Defects Liability Period shall be made good by the Contractor at their expense.

A testing report similar to that shown in Appendix A shall be prepared and signed off by the Contractor and Superintendent witnessing the tests. This report shall be submitted to the Superintendent within five working days of the completion of testing.

DRC-W103.44 DISINFECTION

Following a satisfactory hydrostatic pressure test, and where required by the Project Specification or Superintendent, the Contractor shall disinfect all new pipelines and existing mains taken out of service during construction in accordance with WSA03-2011 Clause 20.

DRC-W103.45 CONNECTION TO EXISTING WATER MAINS

The Principal shall determine whether connections to existing live water pipelines may be undertaken by the Contractor or undertaken by the Principal. This determination will take into account the work involved in making the connection, impact on customers and impact on operation of the live water asset.

For connection works to be undertaken by the Principal, the Principal will not schedule the work until pre-payment of the full quoted cost has been made. Once payment has been made, the Principal will undertake the connection work. The Principal shall be given 10 clear working days' notice, after payment of the quoted charge, of such connections being requested by the Contractor. The Principal may require longer notice in a case where the pipes are greater than DN150 in size.

DRC-W103.46 RESTORATION

Pavements, lawns and other improved areas shall be cleaned and left in the same order as they were at the commencement of the works. Restoration shall be undertaken in accordance with WSA03-2011 Clause 23 which outlines the requirements for pavements, lawns, grassed areas and bushland.

All restored surfaces shall be maintained in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces, and the need for their maintenance may or may not be due to defects which become apparent or arise from events which occur during the Defects Liability Period.

Surplus material shall be removed and disposed of to areas arranged by the Contractor. Any tipping or disposal fees shall be paid by the Contractor, and are deemed to be included in the Contract Sum.

In locations where, in the opinion of the Superintendent, surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the vicinity of the trench to the satisfaction of the Superintendent in such a way as to minimise future erosion of the backfill and adjacent ground surfaces.

Any subsequent settlement of trench fill material after construction shall be made good by the Contractor, as required, by placing additional fill.

Should the Contractor elect to tunnel or use trenchless methods to construct under paving, kerb and gutter or other improved surfaces in lieu of trenching, backfilling shall be so carried out as to restore full support to those surfaces, and payment shall be made for the restoration of the surfaces as though they had been removed and replaced. The Contractor shall remain responsible for the repair of the improved surfaces, if subsequently damaged due to subsidence of the backfill, until the end of the Defects Liability Period.

DRC-W103.47 WORK AS-EXECUTED DETAILS

The Contractor shall prepare a set of Work As-Executed drawings that contain a similar level of detail to the design drawings. The drawings should be clearly marked “As-Executed" with the relevant date and revision number. The Work As-Executed drawings are required to show the all as-built information including coordinates (eastings and northings) of connection points, changes of direction or gradient, invert levels etc, even though the design drawings may not, in all instances, contain this information.

Work As-Executed drawings shall be submitted by the Contractor to the Superintendent in both PDF and AutoCAD DWG format. Drawings shall be prepared to the Map Grid of Australia (MGA) coordinate system.

If, during the Defects Liability Period, the Contractor modifies any of the Works, the modifications shall be included in amendments to the 'As Constructed' drawings and documentation.

APPENDIX A – HYDROSTATIC TESTING FORMS

Part A - Notification of Hydrostatic Testing by Contractor

CONTRACTOR .....

CONTRACT .....

Proposed Hydrostatic Testing

Section	Start Chainage	End Chainage	Size (DN)	Material	Date and Time of Test
A					
B					
C					
D					
E					
F					
G					

Contractor..... (Signature)

.....Date)

Received by - Superintendent..... (Signature)

..... (Date)

- Principal..... (Signature)

..... (Date)

Part B1 – Report of Hydrostatic Pressure Testing – PVC, DICL and MSCL Mains
CONTRACTOR .....

CONTRACT .....

Hydrostatic Testing Results – Constant Pressure (Water Loss) Method M4 AS 2566.2

Section	Required Test Pressure	Actual Test Pressure	Test Start Time	Test Finish Time	Permitted Make-Up Water	Actual Make-Up Water	Pass
A							
B							
C							
D							
E							
F							
G							

Permitted make up water is determined by the formula Q (L/h) = 0.14LDH where L = pipeline length (km), D = pipeline diameter (m) and H = average test head over pipeline (m).

Witnessed by Superintendent ..... (Signature)

.....Date

Contractor ..... (Signature)

.....Date

Part B2 – Report of Hydrostatic Pressure Testing – PE Mains

CONTRACTOR ……..

CONTRACT ……

Results of Hydrostatic Testing – PE Testing as per WSA01-2004 Section 2.13

SECTION ……..

TEST DATE ……. WATER TEMPERATURE……

TEST START TIME ……. TEST FINISH TIME ……

TEST PRESSURE …….

Section	**1 hour**	**2 hours**	**3 hours**	**4 hours**	**5 hours**
Make-up water added L (ΔV)					

Permitted make-up water is determined by the formula V_{all} (L/h) = 0.14LDH where L = pipeline length (km), D = pipeline diameter (m) and H = average test head over pipeline (m).

ALLOWABLE MAKE-UP (V_{all}) ……

0.55 x $\Delta V_{(3h-2h)}$ at 3rd hour + ALLOWABLE MAKE-UP (V_{all}) ……

$\Delta V_{(5h-4h)}$ at 5th hour ……

PASS/FAIL ……..

Witnessed by Superintendent ……. (Signature)

……Date

Contractor……. (Signature)

……Date